



**Joint IOC/WMO/CPPS
Working Group
on the Investigations
of “El Niño”**

Fourth Session

Lima, 31 May - 2 June 1984

15 AVR. 1985

IOC-WMO-CPPS/El Niño-IV/3
Paris, 10 January 1985
English and Spanish only

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1. OPENING

The meeting was declared open at 10 a.m. by Dr. Richard Barber, Chairman of the Joint Working Group.

In welcoming the participants, Dr. Barber commended the efforts of the IOC and CPPS Secretariats in monitoring intersessional activities and in preparing for the Fourth Session of the Joint Working Group, and expressed his appreciation to the Institution hosting the present meeting, the Consejo Nacional de Ciencia y Tecnología (CONCYTEC) of Peru. Dr. Manuel Vegas Vélez, Director-General of the CONCYTEC Office of Technological Affairs, warmly welcomed the delegations, international organizations and observers to the Fourth Session of the Joint Working Group on behalf of the host country, emphasizing the importance to the South-East Pacific countries of research on the "El Niño" phenomenon and adequate co-ordination thereof with extra-regional and global programmes through existing regional and international mechanisms.

A list of the participants is given in Annex IX.

Annex X contains a list of acronyms.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

The Joint Working Group adopted the provisional agenda without making any amendments. The agenda as adopted is given in Annex I.

2.2 DESIGNATION OF A RAPPORTEUR FOR THE SESSION

At the suggestion of the delegation of Colombia, the Joint Working Group appointed Dr. Kenneth Mooney of the US National TOGA Office as Rapporteur for the Session.

2.3 CONDUCT OF THE SESSION

The IOC Assistant Secretary and Technical Secretary of the Joint Working Group, Dr. Fernando Robles, outlined the working procedures for the meeting and proposed a provisional timetable that was adopted.

3. REVIEW OF INTERSESSIONAL ACTIVITIES

3.1 REPORT OF THE IOC SECRETARIAT

The IOC Assistant Secretary reported on the decision to convene the Fourth Session of the Joint Working Group in order to take advantage of the opportunity provided by three consecutive meetings to seek a co-ordinated regional response in the planning of global experiments under consideration by CCCO. (These meetings held between 28 May and 8 June were the Fourth Meeting

of the Scientific Committee of ERFEN, the Fourth Session of the Joint Working Group and the CONCYTEC Regional Workshop on Science, Technology and Environmental Effects: The El Niño phenomenon). The TOGA experiment in particular needed a better definition in its regional framework, in view of the convening of the (International) Conference on the TOGA Scientific Programme (Unesco, Paris, 17-22 September 1984). The objectives and timing of the Fourth Session of the Joint Working Group were reviewed during the Seventeenth Session of the IOC Executive Council (Paris, 31 January to 9 February 1984), as well as the content and recommendations of the Third Session of the Joint Working Group (Cali, Colombia, 21-25 February, 1983).

The IOC Assistant Secretary reported on the recent signature of a Memorandum of Understanding between the Intergovernmental Oceanographic Commission and the "Comisión Permanente del Pacífico Sur" (2 April 1984) which established closer co-operation between the two organizations in the co-ordination of oceanographic research in the Central South-East Pacific Region. The complete text of the Memorandum is appended in Annex IV.

On 7 May a contract was signed between IOC and CPPS with a view to broaden the circulation of the ERFEN Bulletin.

IOC co-sponsored the workshop on the El Niño Phenomenon 1982-1983 organized by CPPS and held at INOCAR Headquarters in Guayaquil, Ecuador (12-16 December 1983).

As on previous occasions, IOC provided assistance for six regional scientists to attend the Fourth Meeting of the Scientific Committee of ERFEN and the Fourth Session of the Joint Working Group, and on this occasion it also provided assistance for regional specialists to attend the CONCYTEC workshop which followed these two meetings.

With joint IOC/FAO support, three specialists from the region took part in the Workshop on the IREP component of the IOC/FAO Programme on Ocean Science in Relation to Living Resources (OSLR) (Halifax, Nova Scotia, 26-30 September 1983). Together with other scientists from the Eastern Pacific region, they promoted a proposal for the study of the recruitment of fish resources in this area, called the "Sardine/Anchovy Recruitment Programme (SARP)".

IOC lent its assistance so that experts from the South-East Pacific could attend the Joint WMO/IOC Regional IGOS Implementation Co-ordination Meeting for the Extended Pacific Region (San José, Costa Rica, 21-25 November 1983).

IOC and WMO organized jointly, between 23 April and 8 May 1984, a mission to CPPS countries in order to examine the regional implementation status of IGOS and IODE systems.

The complete text of the report on intersessional activities submitted by the Secretary of the Joint Working Group is appended in Annex V.

The Joint Working Group approved the report submitted by the IOC Secretariat, with minor amendments which were included in the text appended in the Annex mentioned above.

3.2 REPORT OF THE CPPS SECRETARIAT

In presenting this item on the agenda, the Chairman of the Joint Working Group emphasized the special characteristics of the ERFEN Programme, highlighting its genuinely interdisciplinary nature and its gradual exemplary development as a framework for regional co-operation. He drew attention to the importance of this factor in the coverage of and research on the "El Niño 1982-83" event.

He added that this was also the most important achievement of the Joint Working Group in its catalyzing supportive work on behalf of ERFEN.

The CPPS Assistant Secretary-General for Scientific Affairs, Dr. Rómulo Jordán, made a detailed analysis of activities related to research on "El Niño" under the CPPS and the ERFEN Programme. The following activities were highlighted:

- The workshop on the "El Niño 1982-1983" phenomenon (Guayaquil, Ecuador, 12-16 December 1983) at which 30 scientific papers were presented under the joint auspices of and attended by representatives from IOC, WMO, FAO, the Cartagena Agreement, ITTC, NOAA and the Charles Darwin Foundation.

- Preparation and distribution of eight issues of the ERFEN Bulletin between July 1982 and June 1984, with the likely inclusion of articles in English and Spanish as from the last quarter of 1984.

- High-level representations in support of the Training, Education, Research and Monitoring connected with the "El Niño" Phenomenon in the South-East Pacific Project both in connection with the preparatory assistance project currently negotiated with UNDP and to the Italian Government in the light of new possibilities that have opened up jointly with IOC through the Department of Co-operation for Development and the Italian-Latin American Institute (IILA). He highlighted the exemplary collaboration in both cases, and the support provided by the diplomatic representatives of the four CPPS countries in consulting the UNDP Latin American Office in New York and the Italian Government in Rome.

- Participation in meetings on the planning of extra-regional and global experiments, especially TOGA. With regard to TOGA, he underlined the participation of four scientists from the region in the ad hoc meeting convened by the National Science Foundation of the United States in connection with the Pacific component of this programme (Miami, 11-18 May 1983) and attendance from the CPPS Secretary-General for Scientific Affairs to the First Meeting of the CCCO-TOGA Steering Group (Hamburg, 24-27 August 1983).

In this connection, he stressed that the Seventeenth Ordinary Session of CPPS (July 1983) had resolved to support participation by ERFEN to the TOGA and OSLR international programmes.

- Improvement in the exchange of oceanographic and meteorological data among the countries of the region, through the use of cables and/or telexes

Dr. Jordán again thanked IOC and WMO for their constant and growing support to CPPS activities, especially ERFEN.

The complete text of the report of the CPPS Secretariat is given in Annex VI.

3.3 REPORT OF THE SCIENTIFIC COMMITTEE OF ERFEN

At its fourth meeting (Lima, 28-30 May 1984), the Scientific Committee of ERFEN appointed Dr. J.I. Valencia, Dr. S. Zuta and Dr. H. Santander as spokesmen to present respectively to the Joint Working Group the regional revision of the meteorological, oceanographic and biological components of the programme.

The details of their presentations are appended in Annex VII as they were included in the summary report of the Fourth Meeting of the Scientific Committee of ERFEN which was distributed to the Session of the Joint Working Group for information.

The Joint Working Group received with enthusiastic approval the overall results presented at the ERFEN meeting held a few days earlier. The Working Group was particularly attentive to and concerned about the need for a continued improvement in the data telecommunication system in the region, as well as to an increased use of possibilities provided by ships-of-opportunity. With regard to the latter point, an increased exchange was reported in recent years for certain areas, especially through information provided by ships from the United States, Japan and the Soviet Union. It was emphasized that the lack of equipment and other resources was a limiting factor for a better exploitation of these opportunities.

3.4 REPORT OF THE WMO SECRETARIAT

The report of WMO intersessional activities relating to "El Niño" was introduced by the representative of the WMO, Dr. Peter Dexter. He reiterated that, while the intersessional period of about one year was rather short, this meeting was an important and timely one from the point of view of being able to provide the Joint Working Group with an input to the planning stages of global international research projects such as TOGA, which have been stimulated in large part by the 1982/1983 "El Niño" event. At the same time, he reminded the Working Group that they should be looking ultimately to provide recommendations on regional observing networks and services required for prediction and in response to "El Niño" event.

WMO activities in respect of the World Climate Research Programme are now concentrating on the TOGA research programme, and some WMO requirements and activities in relation to TOGA (and particularly "El Niño" research as a significant regional part of TOGA) were outlined. These included:

- (i) Observational requirements for radio-sonde and precipitation data networks;
- (ii) Real-time observational data;
- (iii) Drifting buoy deployment and co-ordination.

It was stressed that ERFEN countries have a significant role in all these activities, and should become involved at all stages of planning and implementation.

Some details on the WMO/UNDP Project Proposal in relation to El Niño were given and the current status of the proposal outlined. While the proposal is for only very modest funding at this stage, it is intended to provide facilities

not just in relation to El Niño activities, but to the future operation of the WMO World Weather Watch in the region. UNDP funding for the proposal is uncertain at this stage, but consideration is being given to expanding it as an inter-regional project.

Regarding co-ordination with the IOC/CPPS proposal, Recommendation El Niño-IV.1 was adopted.

Other WMO inter-sessional activities have included co-sponsorship (with IOC) of the regional IGOS Extended-Pacific Implementation-Co-ordination Meeting in Costa Rica, the Joint Mission to South-East Pacific countries on IGOS/IODE matters and the sponsorship of three ERFEN meteorologists for attendance at meetings of the ERFEN Scientific Committee and the Joint IOC/WMO/CPPS Working Group. Finally, Dr. Dexter indicated that proposals with respect to an "El Niño" climatological data set are to have high priority in the work of the WMO Commission for Marine Meteorology (Working Group on Marine Climatology).

The complete text of the WMO intersessional report is given in Annex VIII.

4. GLOBAL INVESTIGATIONS PARTICULARLY RELEVANT TO THE SOUTH-EAST PACIFIC REGION

4.1 IOC/SCOR(CCCO) AND WMO/ICSU PROGRAMMES

In the absence of Dr. R. Revelle, who had been invited to introduce this topic, Dr. F. Robles reviewed selected drafts of the TOGA Scientific Plan presented at a meeting in Liège, Belgium, in early May 1984. The stated objectives of the TOGA Programme are:

- (i) To determine predictability of the ocean/atmosphere system on time scales of months to years.
- (ii) To study feasibility of modelling.
- (iii) To design an observing and data transmission system for operational prediction.

The TOGA Programme will consist of the following components:

- (i) An oceanographic observational component;
- (ii) In addition to the World Weather Watch, a limited programme of atmospheric observations and data processing.
- (iii) An air/sea flux measurement component.
- (iv) An ocean modelling component.
- (v) An atmospheric modelling component.

TOGA is scheduled to begin in January 1985 and last for 10 years. Scientific guidance will be supplied by the TOGA Scientific Steering Group and international planning and co-ordination by an International TOGA Project Office.

Special note was made of activities leading up to TOGA, such as:

- (i) The USA contribution to TOGA.
- (ii) The US EPOCS Programme.
- (iii) The US TROPIC HEAT Programme.
- (iv) The ERFEN Programme of Colombia, Chile, Ecuador and Perú.
- (v) The US/France SEQUAL/FOCAL Programmes.

The announcement of a Conference on the TOGA Scientific Programme to be held in Paris on September 17-21, 1984 was made and it was noted that ERFEN should be adequately represented. Various mechanisms for determining the ERFEN representation were discussed as recommended by the Fourth Meeting of the Scientific Committee of ERFEN.

Recommendation El Niño-IV.2 was adopted.

4.2 IOC/FAO OSLR PROGRAMME

The Chairman invited Dr. J. Alheit to introduce this point of the Agenda. Dr. Alheit reviewed the report of the Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources held in Halifax, September 1983. The following recommendations of the Workshop were presented:

- (i) Improve communication and contact between researchers engaged in recruitment studies.
- (ii) Co-operation on the recruitment research of the Anchovy/Sardine complex should be continued and extended as the Sardine/Anchovy Recruitment Programme (SARP).
- (iii) The use of the daily otolith ring technique should be expanded into new regions.
- (iv) Research on adult conditions, fecundity and egg production should be given greater emphasis.
- (v) Improved and calibrated sampling techniques should be developed.
- (vi) Emphasis should be given to better resolution of associated oceanographic conditions, particularly transport and mixing.
- (vii) IOC should organize workshops and visits of scientists to facilitate the exchange of climatic and meteorological data relevant to the recruitment problem.
- (viii) Analysis should be made of most profitable lines of research on the physiology, behaviour and feeding of fish larvae, and on the role of predators.
- (ix) Opportunities for TEMA support in a number of the above research areas should be developed.

The Joint Working Group, recalling previous recommendations and on-going actions (see points 3.1 and 3.2), emphasized the importance of OSLR as a new major international effort to investigate the biological variability associated to the El Niño phenomenon.

5. REQUIREMENTS FOR ON-GOING AND PLANNED ACTIVITIES

5.1 "El NIÑO" UNDP PREPARATORY ASSISTANT PROJECT

The UNDP Project Proposal for "Training, Education, Research and Monitoring connected with the "El Niño" Phenomenon in the South-east Pacific" was originally conceived at the "El Niño" Symposium in Guayaquil (1974) and subsequently developed by IOC and CPPS. The project was thoroughly reviewed during the Second Meeting of the ERFEN Scientific Committee (Lima, November 1981) and approved under Resolution 12 of the Sixteenth Ordinary Session of the CPPS. In January 1983 the proposal was submitted by IOC to UNDP as one of the top priority Unesco regional projects. Due to severe economic constraints UNDP was unable to fund the project at the requested level. Instead, it was estimated at the Third Session of the Joint Working Group that US \$ 120,000 could be provided as a vehicle for the initial implementation of the most urgent component requirements, with a view towards subsequent funding of the global project by UNDP and/or other sources. Between the Third and Fourth Sessions many consultations were held with the Latinamerican Office of UNDP, New York. Based on the most fundamental requirements selected by CPPS, a preparatory project of assistance was presented by IOC and is now under negotiation, for an amount of US \$ 84,000 (eighty four thousand dollars). The objective of this project is the implementation of the most urgent oceanographic, meteorological, biological and training requirements of the integral project, with a view to a total funding of the proposal, either by the UNDP itself (should funds be available for this purpose) or by other sources. According to a letter addressed on 19 April to Unesco by Mr. Hugo Navajas-Mogro, Assistant Director and Regional Director for Latin America of UNDP and taking into account further information provided by telex on May 21, 1984, this proposal is being studied by the UNDP and an early resolution is expected. Mr. Navajas added that support by the Fourth Meeting of the Joint Working Group will be an important consideration for the final decision.

Discussion by the delegations expressed concern and frustration about the delay in implementation of this project. The issue was raised about whether or not it is appropriate to end the long efforts to get this project supported by UNDP. After discussion the consensus was that the Joint Working Group asked IOC and CPPS to concert a final strong effort to implement this very small, but critical support, to the investigations of "El Niño" phenomenon. The delegations, therefore reiterated Recommendation "El Niño"-III.1 (See Annex III).

5.2 TRAINING, EDUCATION, RESEARCH AND MONITORING CONNECTED WITH "EL NIÑO" PHENOMENON IN THE SOUTH-EAST PACIFIC

The delegations noted with satisfaction the joint approach started by IOC and CPPS by the end of 1983, at the Department of Co-operation for the Development of the Ministry of Foreign Affairs of Italy and at the "Instituto Italo-Latinoamericano (IILA)", in order to cover an initial phase of this project of a two-year duration, for an amount of US \$ 722,800. The interest of the Italian Government towards this project was officially communicated to the Ambassadors in Italy of the four countries of CPPS, on March 7, 1984. Afterwards,

each of these countries sent a note to the Italian Government in support of this negotiation. The representative of Italia to the Seventeenth Session of the IOC Executive Council confirmed on this occasion his country's interest in supporting the investigations on "El Niño".

The Joint Working Group supported to the fullest possible extent this new and other alternative initiatives to obtain extra-regional help for continued investigations on "El Niño".

5.3 OCEAN SERVICES (IODE/IGOSS) REQUIREMENTS

In introducing this point, the IOC Assistant Secretary referred to selected chapters of the Report of the Joint IOC/WMO mission to the South-East Pacific countries on IGOS/IODE matters, done in the CPPS countries from 23 April to 8 May 1984 (Doc. IOC/INF-602). The results of the mission were summarized particularly as related to the objectives, main conclusions and recommendations of the mission.

Several delegations emphasized the quality of the Joint IOC/WMO mission report and its extraordinary importance as regards the forthcoming requirements of the global experiments of the WCRP as well as those of ERFEN, the prediction of El Niño events through numerical models in particular. They recognized that the diagnosis and recommendations made will imply, if implemented, substantive resources and innovations and effective co-operation particularly among the regional Member States concerned.

The delegation of Perú called the attention on the related information on IGOS provided by the Joint WMO/IOC Regional IGOS Implementation Co-ordination Meeting for the Extended Pacific Region (Document IOC/INF-558) and the possibilities offered by the WCRP to reinforce this system in the CPPS region. The need for designating marine meteorologists, as national IGOS co-ordinators, preferably connected with National Oceanographic Commissions or similar bodies, was stressed. In a more general context, the same delegation announced the forthcoming International School on Observational Techniques and Interpretation of "El Niño" Phenomenon (Lima, Perú, 1-13 October 1984) organized by the Instituto Geofísico del Perú and the Oregon State University and co-sponsored, among others, by IOC and CPPS.

Other delegations provided information about on-going initiatives to establish specialized IODE/IGOS centres of relevance to the ERFEN region, such as that on sea level and wind stress data being organized in Hawaii. The possibility for CPPS to act in the future as regional focal point for the IODE/IGOS system was also stressed.

The Joint Working Group endorsed the recommendations of the Joint IOC/WMO mission report, in particular those addressed to the CPPS Member States and to IOC and WMO and recommended that the organizations of the group take these recommendations as concrete guidelines when orienting their actions in matters related to IODE and IGOS.

6. THE 1985 INTERNATIONAL SYMPOSIUM ON EL NIÑO

The Joint Working Group adopted the following guidelines regarding the organization of the Symposium:

- (i) Place: The delegation of Ecuador was kindly requested to consider hosting the event in the city of Guayaquil. The Ecuadorian delegation agreed to consider this request and to give a prompt answer.
- (ii) Dates: Subject to the decision about the place, August, September of December 1985 were recommended as possible dates.
- (iii) Co-ordination Groups: Two levels of co-ordination were established for the organization of the Symposium:
 - (a) A central steering group of wide geographical representation but small in membership. Dr. D. Enfield of the USA, Dr. R. Jordán of the CPPS Secretariat, Ecuador and a third member active in related programmes in the West Pacific, were suggested as members of the central steering group. France or a country of the Western Pacific active in El Niño investigations were asked to nominate the third member.
 - (b) A group comprised of a co-ordinator from each of the ERFEN countries, was charged with steering and organizational tasks at the corresponding national levels. Taking into account the recommendation adopted by the Fourth Meeting of the Scientific Committee for ERFEN, this group was formed as follows:

Mr. J. Valencia, for Colombia
Mr. B. Uccellelli, for Chile
Mr. G. Dávila, for Ecuador
Dr. P. Lagos, for Perú.

It was agreed that the two groups will elaborate in a co-ordinated way and in due course, a list of preparatory activities and a time-table for the Symposium, including its general programme and terms of reference for the presentation of papers. They will also explore supplementary funding sources through co-sponsorships in addition to those of IOC, WMO and CPPS.

7. ELECTION OF CHAIRMAN

The delegation of Ecuador proposed Dr. David B. Enfield as Chairman of the group for the next intersessional period. This proposal was unanimously seconded by all participants and Dr. Enfield was elected new Chairman of the Joint IOC/WMO/CPPS Working Group on the Investigations of El Niño.

8. DATES AND PLACE OF THE NEXT SESSION

Chile was proposed as possible place for the next session of the group, to take place in about two years' time. The delegation of Chile accepted in principle this proposal. The IOC, CPPS and WMO Secretariats were asked to co-ordinate with the host country for final dates and place of the Fifth Session of the group.

9. ADOPTION OF THE SUMMARY REPORT AND RECOMMENDATIONS

The Summary Report and Recommendations of the Session were adopted.

10. CLOSURE

The Session was closed at 17.00, on 2 June 1984.

ANNEX I

AGENDA

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ANNEX II

RECOMMENDATIONS

RECOMMENDATION EL NIÑO-IV.1

COORDINATION OF IOC/CPPS AND WMO PROJECT PROPOSALS TO UNDP FOR "EL NIÑO" STUDIES

The Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño",

Noting

- (i) Project proposal RJA/83/010 on "Training, Education, Research and Monitoring connected with "El Niño" phenomenon in the Southeast Pacific" of IOC/CPPS to UNDP;
- (ii) Project proposal RLA/84/A/01/16 on "Meteorological studies of "El Niño", Phase I" of WMO to UNDP;
- (iii) Recommendation No. 3 of the Fourth Meeting of the Scientific Committee for ERFEN,

Recognizing

- (i) The interest and activities of IOC/CPPS in furthering all aspects of regional studies of "El Niño";
- (ii) The interest and activities of WMO in furthering the meteorological studies of "El Niño",

Considering

- (i) The importance of these projects to the continuing and further regional investigations of "El Niño";
- (ii) The additional long-term benefits of the WMO meteorological proposal to the operation of the WMO World Weather Watch within the region,

Considering further that UNDP funds available at this time for the projects may be limited,

Recommends (i) that a co-ordinated project proposal having oceanographic, biological, meteorological and training elements may be in a better position to take advantage of these limited UNDP funds, and (ii) that the Secretariats of IOC, WMO and CPPS consult, with a view to co-ordinating their project proposals and presenting a unified approach to UNDP, covering all four components.

RECOMMENDATION EL NIÑO-IV.2

REGIONAL PARTICIPATION IN THE TOGA PROGRAMME

The Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño"

Considering the great importance of the TOGA Programme for understanding the

"El Niño" phenomenon and the need for a mechanism for an efficient interaction between TOGA and the region,

Emphasizing that the Fourth Meeting of the Scientific Committee for ERFEN recommended co-ordination between ERFEN activities and those which are common with TOGA,

Taking into account that there is coincidence in large part of the objectives of the Joint IOC-WMO-CPFS Working Group on the Investigations of "El Niño" and those of the TOGA Programme,

Having noted that a Conference on the TOGA Scientific Programme will meet at Unesco in Paris during September 1984, and believing that this phase of organizing the programme requires a significant regional participation, both at governmental and scientific levels,

Recommends to IOC, WMO and CPFS

- (i) that co-ordination of TOGA activities in the region be implemented through ERFEN as the regional mechanism for planning and co-ordination with this and other CCCO Programmes of IOC/SCOR and those of the World Climate Research Programme of WMO/ICSU.
- (ii) that appropriate governmental and scientific participation of the ERFEN Programme (in its meteorological, oceanographical, biological and training components) be assured in TOGA meetings, in particular for the Conference on the TOGA Scientific Programme, Paris, September 1984.

ANNEX III

REITERATION OF RECOMMENDATION EL NIÑO-III.1

RECOMMENDATION EL NIÑO-III.1

TRAINING, EDUCATION, RESEARCH AND MONITORING IN RELATION TO THE PHENOMENON OF "EL NIÑO" IN THE SOUTHEAST PACIFIC

The Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño",

Recalling the Recommendation El Niño-II.3 relative to the TEMA component of ERFEN and in particular to the project "Training, Education, Research and Monitoring in Relation to the Phenomenon of El Niño in the Southeast Pacific",

Considering that the drastic reduction made by UNDP in the disposition of funds to cover the budget of the above-mentioned project adversely affects the objectives pursued by ERFEN and that, moreover, this reduction is inconsistent with the considerable economic and human efforts that the CPPS Member States have been making,

Taking into account the great adverse socio-economic impact produced by the 1982-83 El Niño, particularly in relation to the coastal communities, fishing industry and agriculture,

Noting the intimate relation existing between the regional expression of the El Niño phenomenon and other ocean-atmosphere perturbations on the Pacific basin scale as well as the global scale,

Recommends

- i) that the member states of the Joint Working Group, in particular Colombia, Ecuador, Peru, Chile, United States and France, negotiate, through their respective UNDP representatives and with the co-ordinated support of the IOC, WMO and CPPS, a reconsideration of the preliminary budget assigned by UNDP to the project in question, in order to procure financing commensurate with the project needs as approved by Resolution No. 12 of the XVI Ordinary Meeting of the CPPS, and
- ii) that, without precluding the foregoing, the Joint Working Group, through the Secretariats of IOC, WMO and CPPS, promote pertinent negotiations with other organisms, official or otherwise, in order to procure complementary sources of financing for the project.

ANNEX IV

MEMORANDUM OF UNDERSTANDING
BETWEEN THE INTERGOVERNMENTAL
OCEANOGRAPHIC COMMISSION AND THE
COMISION PERMANENTE DEL PACIFICO SUR

The purpose of the present Memorandum of Understanding between the Intergovernmental Oceanographic Commission (IOC) and the Comisión Permanente del Pacífico Sur (CPPS) is to define the fields of application and the modalities for closer co-operation between the two organizations in promoting and co-ordinating oceanographic research programmes in the Central South-East Pacific region.

1.1 The Intergovernmental Oceanographic Commission was established in 1960 through Resolution 2.31 of the Eleventh Session of the General Conference of Unesco as an autonomous body within the aforesaid Organization for the purpose of promoting scientific research with a view to learning more about the nature and resources of the oceans, through the concerted action of its Member States. Moreover, within the United Nations system, the Commission plays the role of a specialized co-ordinating body in the field of marine science and related activities under the agreement establishing the Inter-Secretariat Committee on Scientific Programmes relating to Oceanography (ICSPRO), signed by the UN, Unesco, "FAO, WMO and IMO.

The Comisión Permanente del Pacífico Sur constitutes the "appropriate regional maritime body", as acknowledged by its four Member States (Colombia, Chile, Ecuador and Peru). It was established in 1952 with the objective of implementing the principles of the 1952 Santiago Declaration. It is responsible for co-ordinating maritime policies in the region, including the promotion and co-ordination of marine science, protection of the marine environment and the proper use of marine resources.

2.2 IOC and CPPS shall co-operate in any international programme of interest to the two organizations concerning marine scientific research and related aspects.

3.1 Co-operation between IOC and CPPS shall be exercised with all due respect for the respective areas of competence of both organizations, in a permanent and continuous way. The two Secretariats shall meet periodically, in principle once a year, to exchange information and lay down practical procedures for their co-operation during the succeeding interval. The two organizations shall consult each other continuously on programmes and activities in their sphere of common interest and on the involvement of third parties in such activities. Representatives of IOC and CPPS shall attend the sessions of the Executive Council and General Assembly of IOC and the ordinary sessions of CPPS, respectively.

3.2 CPPS shall facilitate in so far as possible the implementation of IOC scientific programmes and global oceanographic services in the Central South-East Pacific region, including the exercise of its good offices in securing the active participation of research institutions and centres of its Member States.

CPPS shall play, in respect of IOC, the role of an advisory body for oceanographic activities in the Central South-East Pacific region.

3.3 IOC Shall actively contribute, through the provision of its technical advisory services, to the implementation of CPPS' scientific programmes. To this end, IOC shall facilitate the development, co-ordination and use of national and regional oceanographic services within the ambit of its global systems for the exchange of oceanographic data information and products. IOC shall also encourage the strengthening of technical and scientific capabilities in marine science in the countries of the south Pacific system, especially in the framework of its Training, Education and Mutual Assistance (TEMA) programmes.

3.4 Practical procedures to facilitate the implementation of the present Memorandum, especially those concerning joint activities and programmes of interest to both organizations, shall be covered, if need be, by separate specific agreements between the IOC and CPPS Secretariats.

2 April 1984.

Luis Arriaga
Secretary-General,
Comisión Permanente
del Pacífico Sur

Mario Ruivo
Secretary,
Intergovernmental
Oceanographic Commission

ANNEX V

INTERSESSIONAL ACTIVITIES
(Report of the IOC Secretariat)

The decision to convene the Fourth Meeting of the Joint Working Group in Lima, between 31 May and 2 August 1984, has been taken in consultation with the relevant organizations and the Chairman of the Group, taking essentially into account two kinds of reasons: firstly, a practical and financial one, to make it coincide with the Fourth Meeting of the Scientific Committee for ERFEN (Callao, 28-30 May 1984) and on the other hand, considering the possibility for the Joint Working Group to be followed by the CONCYTEC Regional Workshop on "Science, Technology and Environmental Effects: the "El Niño" Phenomenon" (Lima, 4-8 June 1984). Another essential element which contributed to take this decision was the opportunity to look for a well co-ordinated regional expression, with regard to the planification of global experiments under the consideration of the IOC/SCOR Committee on Climatic Changes and the Ocean (CCCCO), which are directly relevant to the study of the "El Niño" Phenomenon and therefore to the deliberations of the Joint Working Group. Among the other experiments under consideration, that relating to the Tropical Ocean and the Global Atmosphere (TOGA) needs, in particular, a better definition in its regional framework, in view of the convening of the (International) Conference on the TOGA Scientific Programme to be held at Unesco Headquarters in Paris, between 17 and 28 September 1984.

The objectives and the timing of this Fourth Meeting of the Joint Working Group were announced during the Seventeenth Session of the IOC Executive Council (Paris, 31 January - 9 February 1984), as part of the agenda item regarding "Cooperation and joint activities with the Comisión Permanente del Pacífico Sur". The IOC Executive Council also examined in this occasion the content and recommendations of the Third Meeting of the Joint Working Group held in Cali, Colombia, 21-25 February 1983 (Document IOC-WMO-CPPS/El Niño-III/3). On the same occasion, the CPPS Observer and Member of the IOC Executive Council, Ambassador J.M. Bákula, made a detailed presentation on the regional efforts being realized with respect to the investigations on "El Niño", with special mention regarding those efforts concentrated on the 1982-83 Phenomenon. Referring to the CCCC global experiments planned for the next 10 years, the CPPS representative called the attention on the need to orientate the planification, financing and implementation of these experiments, preferably through the existing regional and international mechanisms, represented in this case by IOC, WMO and CPPS, rather than by bilateral agreements between interested countries. The CPPS representative also informed the IOC Executive Council on the Second Meeting of the Ministers of Foreign Affairs of the South Pacific System (Viña del Mar, Chile, 9-11 February 1984) and on the opportunity of providing the conclusions of the IOC Executive Council to this meeting in this regard; suggestion which was adopted and implemented by the Executive Council. The Chairman of IOC also took this opportunity to inform the Executive Council about the Agreement between the Intergovernmental Oceanographic Commission and

the Comisión Permanente del Pacífico Sur which was to be signed by both Secretariats. The objective of this agreement, signed on 2 April 1984, is to determine the fields of application and modalities for a closer collaboration between both organizations with regard to the promotion and coordination of programmes of oceanographic investigations in the Central-Southeast Pacific region; the agreement states that the cooperation between IOC and CPPS will interact in any international programme of interest to both organizations regarding investigations in marine sciences and their related aspects. In this context, the CPPS will facilitate, according to its possibilities, the implementation for the scientific programmes and global oceanic services of IOC in the above-mentioned region and will act with respect to IOC, as a consultative body for the oceanographic activities in the Central-Southeast Pacific region. IOC, on its side, will actively contribute, by providing technical advice, to the implementation of the CPPS scientific programmes, facilitating to that end the development, coordination and use of the data and oceanographic products exchange at the national, regional and global levels, likewise, stimulating the strengthening of the scientific and technical capacities in the field of marine sciences in the countries of the South Pacific System, particularly in the framework of its Training, Education and Mutual Assistance programmes (TEMA). The agreement acknowledges the capacity of CPPS to constitute "the appropriate maritime regional body" for the South-East Pacific region. During the IOC Executive Council, many Member States expressed their satisfaction regarding the exceptional collaboration developed between IOC and CPPS, also giving their support and approval to the Summary Report and Recommendations of the Third Meeting of the Joint Working Group. Several delegations also expressed the need to establish an appropriate link between the activities relevant to the Joint Working Group and ERFEN and those, of a global character, of CCCO of IOC/SCOR. It was emphasized that this link should be established and maintained within an intergovernmental framework. The IOC Executive Council reiterated its support to the regional project on "Training, Education, Investigation and Monitoring in relation to the "El Niño" Phenomenon in the South-East Pacific" presented to UNDP, and urged its Member States to obtain, through their representatives to the UNDP, the final approval and integral financing of this project, and also to consider alternative ways for funding this proposal. In conclusion, the Council warmly thanked the Government of Colombia for all the excellent facilities provided during the Third Meeting of the Joint Working Group in Cali, Colombia, in February 1983.

As far as the proposal presented by UNDP is concerned, after many consultations held with the Latinoamerican office of this Organization and based upon basic requirements selected by CPPS, a preparatory project of assistance was presented and is now under negotiation, for an amount of US \$ 84,000 (eighty four thousand dollars), the objective of which is the implementation of the most urgent oceanographic, meteorological, biological and training requirements of the integral project, with a view to a total funding of the proposal, either by the UNDP itself (should funds be available for this purpose) or by other sources. According to a letter addressed on 19 April to Unesco by Mr. Hugo Navajas-Mogro, Assistant Director and Regional Director for Latin America of UNDP and taking into account further information provided by telex on 21 May, this proposal is being studied by the UNDP and an early resolution is expected.

Mr. Navajas added that the orientation provided by the Fourth Meeting of the Joint Working Group will be important for taking a final decision. In the same context, it is worth mentioning the joint approach started by IOC and CPPS by the end of last year, at the Department of Cooperation for the Development of the Ministry of Foreign Affairs of Italy and at the Instituto Italo-Latinoamericano (IILA), in order to cover the initial phase of this project for an amount of US \$ 722,800. The interest of the Italian Government towards this project was officially communicated to the Ambassadors in Italy of the four countries of CPPS, on 7 March 1984. Afterwards, each of these countries sent a note to the Italian Government in support of this negotiation. Further information about this initiative is expected for the month of July 1984. The representative of Italy to the Seventeenth Session of the IOC Executive Council confirmed on this occasion his country's interest in supporting the investigations on the "El Niño".

On 7 May, IOC and CPPS signed a contract to strengthen the diffusion of the ERFEN Bulletin. To that end, the IOC will provide US \$ 9,000 to the CPPS Secretariat, with a view to support the bilingual printing (Spanish/English) of the next six issues of the ERFEN Bulletin, which will be distributed, in addition, to extra-regional institutions of the IOC Member States which are participating or have an interest in the El Niño investigations.

The IOC co-sponsored the Workshop on the "El Niño" Phenomenon 1982-83 organized by CPPS and held at the Instituto Oceanográfico de la Armada (INOCAR), in Guayaquil, Ecuador, 12-16 December 1983. IOC provided financial assistance for the participation of four invited scientists. As in previous opportunities, IOC gave its financial support for the participation of six regional scientists to the Fourth Meeting of the Scientific Committee for ERFEN and to this Fourth Session of the Joint Working Group; it is also supporting the participation of three of these six experts in the seminar organized by CONCYTEC which follows this Session.

Three specialists of the CPPS countries were invited to participate, in their expert capacity, in the Workshop on the IREP component (International Recruitment Project) of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR), held in the Bedford Institute of Oceanography, Halifax, Canada, 26-30 September 1983 (IOC Workshop Report No. 33). This participation was possible thanks to the joint support of IOC and FAO. Jointly with other specialists from the Eastern Pacific Region, they played an important role in the development of a proposal for the study of the variability of the Anchovy and Sardine Recruitment in the Eastern Pacific (SARP), to be considered in the First Meeting of the OSLR Guiding Group of Experts for OSLR (Paris, 16-20 July 1984). In connection with this initiative, IOC, the Peruvian/German Co-operative Programme for Fisheries Investigations (PROCOPA) and the "Instituto del Mar del Perú (IMARPE)" are considering the joint organization during 1985, of a regional course on the eggs production method used to estimate the spawning biomass of some pelagic fishes. During the Seventeenth IOC Executive Council, the USA and the Federal Republic of Germany representatives, among others, confirmed the interest of their countries in collaborating in the development of regional co-operative investigations related to OSLR/IREP. The Executive Council endorsed the conclusions and recommendations of the Halifax Workshop.

In connection with recommendations previously formulated or endorsed by the Joint Working Group on the Investigations of "El Niño" concerning regional requirements dealing with processing and exchange of data and products, the IOC and WMO jointly organized, some weeks ago, a mission to the countries of CPPS (in the framework of the IODE AND IGOS global systems). The mission took place between 23 April and 8 May 1984. It formulated recommendations on how to improve the existing facilities with a view to cover the needs for global experiments such as those of the World Climate Research Programme and its oceanic component represented by CCCO. as well as those arising from the regional investigations of El Niño phenomenon.

ANNEX VI

REPORT OF THE CPPS SECRETARIAT

ERFEN Programme Co-ordination Activities 1983-1984

The Scientific Committee of ERFEN and the scientific community involved in research on El Niño have been particularly active in the past two years because of the presence of El Niño 1982-1983, one of the most intense and destructive in history.

The countries belonging to the Comisión Permanente del Pacífico Sur responded very actively in carrying out oceanographic cruises and research on the development of this El Niño event. In addition, Ecuador and Peru had to make considerable investments in order to alleviate the emergency situation and repair the damage caused by nature, resulting in losses estimated at more than two thousand million dollars.

The CPPS tried to do its best according to these circumstances by carrying out its ERFEN programme co-ordination role. The most outstanding activities following the third meeting of the Scientific Committee of ERFEN, are listed below:

1. THIRD MEETING OF THE CPPS SCIENTIFIC COMMITTEE OF ERFEN

This meeting was held in Cali, Colombia, between 14 and 19 February 1983, under the chairmanship of Dr. Francisco Rodríguez.

The most striking aspect of this meeting was the analysis of a wealth of recent scientific information on El Niño 1982-1983, which started to appear in the South-East Pacific region in October 1982. This fact was highlighted during the Seventeenth Session of the IOC Executive Council.

The scientific report prepared during the meeting was submitted to the Third Session of the Joint IOC/WMO/CPPS Working Group on the Investigation of El Niño, held immediately afterwards in Cali, from 21 to 25 February 1983. The CPPS Secretary for Scientific Affairs presented a general report to the meeting, and members of the Scientific Committee of ERFEN (Dr. Iván Valencia, Professor Salvador Zuta and Dr. Roberto Jiménez) presented the meteorological, oceanographic and fisheries-biology aspects respectively, on behalf of the Committee.

The report of the Third ERFEN meeting was circulated immediately afterwards.

2. WORKSHOP ON THE EL NIÑO PHENOMENON 1982-1983

Following the decision of the Seventeenth Ordinary Session of the CPPS, this workshop took place in Guayaquil from 12 to 16 December 1983 under the Chairmanship of the Director of INOCAR, Captain Patricio Padilla. Thirty scientific papers were submitted and discussed.

Some 20 scientific, academic and technical institutions from the region attended this international gathering along with representatives from international organizations such as IOC, WMO, FAO, NOAA, ITTS, the Cartagena Agreement and the Charles Darwin Foundation.

Papers submitted by their authors in final version were edited and sent to press in May 1984. They will be published in the "Revista Pacífico Sur" No. 15. The deadline for the receipt of papers which have still not been submitted in their final version was put back to 15 June at the latest.

The Summary Report of the workshop was circulated in January 1984. The ERFEN Bulletin No. 6 (December 1983) was devoted to the conclusions and recommendations of the workshop and ERFEN Bulletin No. 7 (April 1984) to the detailed reports of the working groups.

3. ERFEN BULLETIN

The following issues of the ERFEN Bulletin have been published since CPPS started work in its Quito offices:

Bulletin No. 1	July 1982
Bulletin No. 2	November 1982
Bulletin No. 3	March 1983
Bulletin No. 4	July 1983
Bulletin No. 5	September 1983
Bulletin No. 6	December 1983
Bulletin No. 7	April 1984

At this meeting, ERFEN Bulletin No. 8 corresponding to June 1984 will be distributed.

The support of ERFEN Committee members and scientists in the region is now all the more essential if this ERFEN information vehicle is to continue receiving contributions in the form of short articles.

I must inform you that CPPS recently signed an agreement with IOC whereby the IOC will provide economic support to CPPS so that the ERFEN Bulletin will contain articles in English and Spanish and may extend its circulation to the different continents, and in particular to the countries of the Pacific Basin.

It may be useful to remind members of the Scientific Committee of the need for co-ordination in each of their countries in order to encourage researchers to submit their findings for publication in the ERFEN Bulletin. Contributions for the next issue of the ERFEN Bulletin in September 1984 will be accepted until 15 July 1985.

4. THE "TRAINING, EDUCATION, RESEARCH AND MONITORING CONNECTED WITH THE EL NIÑO PHENOMENON IN THE SOUTH-EAST PACIFIC" PROJECT

Action taken by CPPS, IOC and Governments of the region has succeeded in making international organizations aware of the assistance required. The situation can be summarized as follows:

a) Representations to UNDP

An offer of about US \$ 75,000 was secured following joint representations by CPPS and IOC. In order to make it effective, IOC submitted to UNDP in March 1984 an El Niño Preparatory Assistance Project (RLA/83/010 EL NIÑO) for the sum of US \$ 84,000. This preparatory assistance consists of the following components: personnel, training, equipment and miscellaneous.

b) Representations to the Italian Government

In October 1983, the CPPS Secretary-General and Ambassador J.M. Bákula of Peru (a member of the IOC Executive Council), began talks with representatives of the Italian Government and the "Instituto Italo-Latinoamericano" (IILA), on the possibility of granting aids to research on El Niño.

These initial talks were followed by a series of representations by IOC and the representatives of CPPS Governments.

In February 1984, IOC presented the Project "Training, Education, Research and Monitoring connected with the El Niño Phenomenon in the South-East Pacific Phase I" to IILA and to the Department of Co-operation for Development of the Ministry of Foreign Affairs in Italy. The amount requested was US \$ 722,800.

Since then, there has been a series of representations by the Ambassadors of CPPS countries to the Government of Italy. Document ERFEN CC-IV/11 reports on the notes exchanged between Ambassador Teodoro Bustamante, Chairman of the Ecuadorian National Section of the Comisión Permanente del Pacífico Sur and the Secretary-General of CPPS. This document mentions the favourable disposition of the Italian Government towards providing support to the El Niño Project.

In a cable dated 19 March 1984 IOC informed CPPS of advanced negotiations with the Government of Italy and called for the updating of counterpart contributions for the period 1985-1986.

On 23 April 1983, Ambassador Bustamante informed CPPS of new representations made by the Ambassadors of Colombia, Ecuador, Chile and Peru to the Government of Italy and to IILA.

c) Document submitted by WMO to UNDP entitled "El Niño Meteorological Study - Phase I"

This document was submitted to the CPPS General Secretariat by Mr. Virgilio Torres-Molinoso, WMO representative, in late March 1984, without prior discussions on the subject. It requested US \$ 100,000 from UNDP for the period 1984-1986 with a possible contribution of US \$ 175,000 from the governments. CPPS has no further information on the matter, nor did it take part in the preparation of this initiative. The General Secretariat sent the documents to ERFEN members on 18 April so that they could put forward their conclusions and recommendations at the present meeting.

5. EXTRAREGIONAL PROJECTS (TOGA)

a) At the invitation of the US National Science Foundation and through CPPS, ERFEN members J. Iván Valencia, Salvador Zuta, Nelson Silva and the CPPS Secretary for Scientific Affairs participate in a co-ordination meeting at Miami from 11 to 18 May 1983. Document ERFEN CC-IV/9 reports on the attendance

to this meeting and contains suggestions for possible participation by the ERFEN Programme in the Pacific component of TOGA.

b) Document ERFEN CC-IV/10 reports on the Draft TOGA Programme (Hamburg meeting, 24-27 August 1983). This report, together with document 9 (op. cit.) could be used to determine oceanographic and climatological observation strategies, and possible levels of participation by ERFEN.

c) The Seventeenth Ordinary Session of CPPS (July 1983), decided to "support participation by ERFEN and its mutual relationships with the IOC programmes TOGA and OSLR" (Resolution No. 12).

6. EXCHANGE OF OCEANOGRAPHICAL AND METEOROLOGICAL DATA

In the spirit of Recommendation No. 2 of the Third Meeting of ERFEN and pursuant to the agreement adopted during the Workshop on the El Niño Phenomenon of December 1983 (Recommendation No. 2), ERFEN institutions have started to exchange data. CPPS has retransmitted them via telex or cable. It is hoped that this system may be improved in future.

7. FOURTH MEETING OF THE CPPS SCIENTIFIC COMMITTEE OF ERFEN AND FUTURE MEETINGS

a) The Fourth Meeting of the CPPS Scientific Committee of ERFEN was convened, after harmonizing the mandate of the Seventeenth Ordinary Session of CPPS, to support the CONCYTEC Seminar in Lima and the need to co-ordinate with the Fourth Session of the Joint IOC/WMO/CPPS Working Group, in accordance with consultations with IOC.

This circumstance has reduced the number of working days of the Scientific Committee. However, we hope that since scientific progress was reviewed in detail last December, this progress can be updated and the Plan of Action for 1984-1985, devised.

A note circulated on 11 May provides information on the series of three meetings held in Lima from 28 May to 8 June, 1984.

b) It is announced that, pursuant to Recommendation No. 12 of COCIC-X, during its next meeting scheduled for November this year, a seminar will be held on "The interaction of atmospheric and oceanic phenomena and their impact on living marine resources in the South-East Pacific".

c) The International Symposium on El Niño is scheduled for 1985.

To conclude this short review I must emphasize the constant support received from IOC. The current ERFEN meeting was held thanks to support from IOC, WMO and CPPS and is co-sponsored by IMARPE, once again our host institution.

8. SEVENTEENTH ORDINARY SESSION OF CPPS (QUITO, JULY 1983) AND SECOND MEETING OF MINISTERS OF FOREIGN AFFAIRS (VIÑA DEL MAR, FEBRUARY 1984)

On account of the importance given by the four CPPS countries to the "El Niño" problems and the ERFEN Programme in particular, resolutions supporting ERFEN as one of the priority programmes of CPPS were adopted at each of the meetings mentioned above.

9. MEMORANDUM OF UNDERSTANDING BETWEEN THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION AND THE COMISION PERMANENTE DEL PACIFICO SUR (APRIL 1984)

CPPS expressed satisfaction over this agreement with IOC whereby IOC, by recognizing CPPS as the competent regional body, gives it greater scope for bilateral co-operation among both institutions and supports CPPS activities in the South-East Pacific.

ANNEX VII

SUMMARY OF THE FINDINGS OF THE PROGRAMMES
OF THE SCIENTIFIC COMMITTEE OF ERFEN

Members of the three programmes of the Scientific Committee of ERFEN analysed the meteorological, oceanographic and fisheries-biology conditions in the region during "El Niño" 1982-1983, taking into consideration the findings of the Guayaquil Workshop and including information obtained early in 1984. A summary of this work is presented below.

1. Meteorological Programme

- (a) Meteorological observation at coastal stations during the period preceding the appearance of El Niño showed no substantial deviations from characteristic values.
- (b) Deviations of meteorological parameters in the coastal area started in September-October 1982 with peak values between December 1982 and February 1983 and in a lesser degree in May-June.
- (c) Heavy rainfall in various areas of the region during El Niño 1982-1983 were due to the influence of the Intertropical Convergence Zone activated by changes in the ocean energy balance. This situation led to semi-permanent disturbances producing enormous cloud systems off the entire coast up to 60° South.
- (d) The stabilization of meteorological conditions which started during the second half of 1983 continued gradually and slowly during the first quarter of 1984.
- (e) During the month of February 1984, heavy rainfall (100 per cent above the normal) was noted along the entire northern coastal area of the region (Northern Peru, Ecuador and Southern Colombia).
- (f) All the countries of the region have made a great effort to increase the number of meteorological observations recorded as well as to exchange information. This has yielded very positive results and encouraged the carrying out of studies and research on El Niño.
- (g) The group analysed the WMO project submitted to UNDP on meteorological aspects of El Niño, and recommended that support should be given through strengthening the meteorological component of the ERFEN programme.

2. Oceanographic Programme

The Oceanographic Programme carried out an analysis of El Niño 1982-1983 in its different phases. The outstanding picture deduced from the monitoring done by the four countries was that major oceanographic anomalies became noticeable off the coasts of Colombia, Ecuador, Peru and Chile as from October-November 1982;

- (a) In November 1982, a flow of water from the Gulf of Panama, with unusually low salinity, was observed off Ecuador and it continued southwards down to at least 14° South in February 1983.
- (b) Subtropical Surface Water with unusually high salinity (35.7 per thousand) spread southwards to at least 26° South off the coast of Chile in May 1983.
- (c) The anomalous warming of the sea surface occurred between the second half of 1982 and the first half of 1983, falling sharply around July-August 1983 to remain very close to normal for the rest of the year until early 1984.
- (d) Sea level observations at the tidal stations of La Libertad, Callao and Antofagasta reveal two anomalous maxima which are associated with the high temperature anomalies.
- (e) The thermocline drop was evident off the coast of Ecuador and down to 14° South. South of this latitude the thermocline did not sink but there were major isothermal fluctuations beneath it.
- (f) Observations from September to December 1983, show a return to normal conditions in the thermal structure with the development of coastal and equatorial upwelling.
- (g) During the first quarter of 1984, oceanographic conditions were within the normal range of variability of the area.

3. Biological Programme

- (a) During the second half of 1982 and the first quarter of 1983, significant changes were observed in phytoplanktonic composition, distribution and biomass in the South-East Pacific, the most indicative factors being lower concentration of phytoplankton, drastic reduction in the area of distribution of diatoms located on very near-shore coastal strips and the abundance and broad distribution of warm water oceanic dinoflagellates among neritic plankton. This situation became more pronounced during the second quarter of 1983 until August when the drop in the abundance of ocean dinoflagellates along the coastline, the increase in number of diatoms and the reappearance of Photoperidinium obtusum marked the beginning of a gradual return to normal. During the last quarter of 1983, the intensification of conditions observed in August, together with red tide recordings due to Messodinium rubrum and a significant increase in the chlorophyll values associated with the return of equatorial upwelling conditions, especially to the west and east of the Galapagos Islands, indicated that the phytoplankton was returning to normal conditions, although its composition and biomass were still not completely normal for the South-East Pacific region.
- (b) During the El Niño 1982-1983 phenomenon, the zooplanktonic biomass was reduced and exhibited variations in its specific composition.

Significant changes were recorded in the ichthyoplankton from 1°00' North to 28°00' South, mainly among species such as "sardines" Sardinops sagax and "mackerel" Scomber japonicus, and among "juel" Trachurus murphyi, "anchoveta" Engraulis ringens and other fish species in more restricted areas.

These changes were reflected in the displacement of normal areas of distribution, southwards and coastwards, and a reduction in the abundance of spawning of sardines off Ecuador and Peru, while spawning increased off Chile. In addition, substantial increases in the larval distribution of mackerel were recorded off Peru and Chile only.

An increase in the larval abundance of "jurel" was observed off Peru only. The anchoveta spawning and larval distribution areas were drastically reduced off Peru and Chile. Ichthyoplankton species have increased in diversity and changes were discerned in the distribution of species from the equatorial areas southwards and from the ocean coastwards. This was related to the displacements of equatorial and subtropical surface waters.

During the post-Niño phase (September-December 1983) sardines returned to near normal levels off Ecuador and Chile and although spawning levels off Chile continued to be as observed during the phenomenon, the values were below normal. Mackerel, which was widely distributed in greater density during the phenomenon off Ecuador and Peru, continued to increase; however density levels fell off Ecuador during the last quarter of 1983.

(c) El Niño 1982-1983 had strong and wide-ranging effects on fishing resources and of all the El Niño occurrences recorded to date, it is the one which has most affected the fishing resources of the region.

(d) The anchoveta population, which had already fallen seriously on account of fishing and previous phenomena, has been reduced to the lowest levels recorded in the history of this fish resource.

(e) El Niño 1982-83 altered the distribution and behaviour patterns of sardines. The sardine population nearly disappeared completely from Ecuadorian waters and became concentrated in the southern area of Peru and in the northern part of Chile. The total sardine biomass also fell by nearly 20 per cent on account of body weight loss and possibly a rise in natural mortality. The reproductive cycle was also affected and it is possible that environmental conditions caused higher mortality rates among larvae and juveniles. This may reduce recruitment later on and have serious repercussions on the fishing of this species in the years ahead.

(f) The jurel population expanded its latitudinal distribution area as a result of El Niño 1982-83 and apparently the total size of the population has been maintained and may even have increased. There have been changes in the vertical distribution and vulnerability of this fish which facilitated its catch off northern Chile and, for the first time in history, off Ecuador, whereas in the Peruvian area the jurel catch has been low, even though the biomass has remained at high levels.

(g) The area of distribution of mackerel increased during this El Niño phenomenon, but the species disappeared off Ecuador during the last quarter of 1983. Its apparent abundance was reduced off Chile but there were no notable changes off Peru.

(h) The hake off Peru was displaced towards the continental slope, thus expanding its area of distribution. Catches of this species fell on account of lower vulnerability. Other demersal species increased their area of distribution and indeed considerable increases were observed in other populations such as

scallops Argopecten purpuratus off Peru and shrimp off Ecuador, and this had favourable results on the commercial exploitation of these species.

(i) There were biological and distributional changes in pelagic resources such as sardine, jurel and mackerel in accordance with the development of the phenomenon. There was a general redistribution in relation to normal patterns off Ecuador, Peru and Chile, and the catch started to increase again. The distribution of jurel was extended northwards (Ecuador) where it had never been recorded before. The biological conditions of the three species expressed in terms of length to weight ratio returned to normal values.

(j) The distribution of anchoveta remained very limited in the southern area off Peru.

(k) Prawn species which were widely and densely distributed during the phenomenon have returned to their usual areas of distribution.

(l) The tropicalization of the ecosystem led to the immigration of more than fifty species of fish off Peru.

There was an extraordinary increase in the abundance of some crustaceans such as Penaeus stylirostris and Xiphopenaeus riveti and molluscs such as Argopecten purpuratus. On the other hand other species died or were reduced in number.

Increased oxygen during El Niño 1982-83 could have had favourable effects on the benthos and on demersal species.

(m) Marine birds and in particular the white-breasted cormorant or guanay Phalacrocorax bougainvillii, the booby (or piquero) Sula variegata, and the chuita Phalacrocorax gaimardi, suffered tremendous negative consequences, with a fall in their already depleted populations.

Summary reports on the research activities undertaken under the ERFEN programme are contained in Annexes III, IV and V of the Report of the Fourth Meeting of the CPPS Scientific Committee of ERFEN.

ANNEX VIII

REPORT OF THE WMO SECRETARIAT

1. General

Clearly the 1982/1983 El Niño event has stimulated international scientific interest in problems related to interannual climate variability and global atmosphere ocean interactions, resulting in a number of large-scale and long-term research programmes such as TOGA. One of the major outcomes of these will hopefully be a predictive capability for El Niño. Thus, while the intersessional period has been rather short, the meeting of the Joint Working Group at this time has an important role to play in providing input to the planning stages of these programmes with regard to its requirements for El Niño research and prediction. In particular, this Session of the Working Group should be looking to provide recommendations on:

- (i) observation networks required for prediction, and the ways in which National Meteorological Services may be assisted to achieve these;
- (ii) planning required for local services in response to El Niño events.

2. WCRP -- TOGA

Although the Tropical Ocean Global Atmosphere (TOGA) research programme is discussed more fully under Agenda Item 4.1, a few comments concerning WMO activities will be offered here, since TOGA is assuming a position of central importance to the World Climate Research Programme (WCRP) of WMO, which is now involved with the planning for TOGA and related activities. While TOGA is concerned with large-scale (global) atmospheric/oceanic processes, and its emphasis will be on these rather than more specific manifestations such as El Niño, nevertheless, the El Niño investigations will form an important and integral regional part of TOGA.

The TOGA programme objectives may be summarised as:

- to understand atmospheric wave modes;
- to understand air-sea interaction processes;
- to construct ocean models with predictive capacity;

relevant to the overall problem of interannual climate variability. While planning for TOGA is now underway, some ideal requirements for atmospheric observation networks for the programme may include (i) radiosonde stations every 20° along the equator, particularly in the South American region, reporting in real-time via the GTS; (ii) processed precipitation data, from a station network-density approaching one station per 25,000 km².

In general, real-time data will play a significant part of the overall TOGA programme, and these data will, of course, be available to all countries in the region via the GTS. Thus the strengthening of the regional observational

network required for TOGA will be important for El Niño studies and also as part of the World Weather Watch of WMO.

A proposal concerning the possible formation of a consortium of countries involved in drifting buoy programmes (either as providers or deployers) is to be put before the thirty-sixth session of the WMO Executive Council, Geneva, 6-23 June 1984. The consortium is intended both as a mean of co-ordinating buoy deployments and as a way of sharing costs and technology associated with drifting buoys. Since drifting buoys, both in the Southern and Equatorial ocean, will form a significant part of the TOGA observational programme, this proposed consortium is of obvious relevance to TOGA. At the same time, since it is clear that ERFEN countries can play an important role in buoy programmes, and such buoys will provide considerable meteorological data in the ERFEN region, these countries are urged to take part in all relevant activities associated with drifting buoy programmes. As a first step towards a more complete involvement in buoy programmes, ERFEN countries could gain acquaintance with buoy technology through the initiation of their own buoy programmes on a modest scale, perhaps funded by co-operative assistance programmes.

3. WMO/UNDP Project Proposal

WMO has submitted a project proposal to UNDP, involving funding of around US \$ 100,000 for an El Niño meteorological project. The objectives of this project include:

- (i) improvement in capabilities of ERFEN countries for monitoring and prediction, through strengthening basic organizations;
- (ii) improvement in meteorological data, both real-time and non-real-time available in the region, including land and sea surface data, upper air, satellite data readout capabilities and improvements to the GTS.

While UNDP is in agreement with the details of this proposal, it appears that money may not be available this year to fund it. Consideration is now being given to expanding the project into an inter-regional one, and input will be sought from ERFEN countries into this expanded proposal. At the same time, regionally prepared specific proposals are also important, and WMO will be happy to give consideration to their support.

4. Other activities

Other activities of WMO during the intersessional period include:

- (i) co-sponsoring with IOC the Regional IGOS Implementation Co-ordination Meeting for the Extended Pacific Region (Costa Rica, November 1983);
- (ii) co-sponsoring with IOC, the Joint Mission to South-East Pacific countries on IGOS/IODE;
- (iii) sponsoring three regional meteorologists from ERFEN countries to attend the meeting of the ERFEN Scientific Committee and the Joint El Niño Working Group Session.

Finally, proposals with regard to an El Niño climatological data set have been prepared by the Chairman of the WMO Commission for Marine Meteorology (CMM) (Working Group on Marine Climatology). If this Working Group is re-established by the Ninth Meeting of CMM (October 1984), these proposals will form the basis for a high-priority project for the Working Group.

ANNEX IX

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ANNEX X

LIST OF ACRONYMS AND ABBREVIATIONS

CCCO	Committee on Climatic Changes and the Ocean
CMM	Commission for Marine Meteorology
CONCYTEC	Consejo Nacional de Ciencia y Tecnología
COCIC	Comisión Coordinadora de las Investigaciones Científicas
CPPS	Comisión Permanente del Pacífico Sur
El Niño	(Oceanographic phenomenon off the west coast of South America)
EPOCS	Equatorial Pacific Ocean Climate Study
ERFEN	Estudio Regional del Fenómeno "El Niño"
FAO	Food and Agriculture Organization of the United Nations
FOCAL	Programme Français Océan et Climat dans l'Atlantique Equatorial
GARP	Global Atmospheric Research Programme
GTS	Global Telecommunication System
HIMAT	Instituto Colombiano de Hidrología, Meteorología y Adecuación de Tierras
ICSPRO	Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography
ICSU	International Council of Scientific Unions
IGOSS	Integrated Global Ocean Services System
IILA	Instituto Italo-Latinoamericano
IMARPE	Instituto del Mar del Perú
IMO	International Maritime Organization
INAMHI	Instituto Nacional de Meteorología e Hidrología (Ecuador)
INDERENA	Instituto Nacional de Recursos Renovables Naturales (Colombia)
INOCAR	Instituto Oceanográfico de la Armada (Ecuador)
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange; IOC Working Committee on IODE

IREP	International Recruitment Project
NOAA	Nacional Oceanic and Atmospheric Administration (USA)
ORSTOM	Office de la Recherche Scientifique et Technique Outre-Mer (France)
OSLR	Ocean Science in relation to Living Resources (IOC Programme)
PROCOPA	Peruvian/German Co-operation Programme for Fisheries Investigations
SARP	Sardine/Anchovy Recruitment Programme
SCOR	Scientific Committee on Oceanic Research
SENAMHI	Servicio Nacional de Meteorología e Hidrología (Perú)
SEQUAL	Seasonal Equatorial Atlantic Experiment
TEMA	Training, Education and Mutual Assistance in the marine sciences; IOC Working Committee for TEMA
TOGA	Tropical Oceans and the Global Atmosphere
Unesco	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Programme
WCRP	World Climate Research Programme
WMO	World Meteorological Organization